

PATENT SPECIFICATION

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COMPLETE SPECIFICATION

New and Improved Blasting Initiator

We, IMPERIAL CHEMICAL INDUSTRIES LIMITED, of Imperial Chemical House, Millbank, London, S.W.1, a British Company, do hereby declare the invention, for which we

5 pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with a new and improved blasting initiator which is particularly suitable for use under high hydrostatic pressures.

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In deep wells it frequently occurs that the casing becomes jammed or the drill becomes jammed during drilling. One method of freeing such jammed drills or casings is to fire a small explosive charge in the vicinity while simultaneously applying a torque from the upper end. The explosive charge used frequently takes the form of a number of suitable lengths of a detonating fuse.

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The object of the present invention is to provide an initiator suitable for such charges and similar purposes.

An initiator capable of resisting hydrostatic pressure according to the invention comprises a container, closure means therefor, and a screw cap for the container wherein said container has within it a charge of an explosive composition having a high velocity of detonation and an electric detonator the base of which is in close proximity to said charge and the leading wires of which pass through said closure means, wherein said closure means and screw cap form a pressure resisting fluid-tight seal for the container, wherein said container is provided with means external to it to permit the positioning of at least one length of detonating fuse in the vicinity of the container, and wherein at least a portion of said container is adapted on the firing of said detonator and the explosion of said charge to permit initiation of said detonating fuse.

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The electric detonator used in the initiator of the invention may frequently be any

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commercial electric detonator, for example a No. 6 detonator having a lead azide-lead styphnate-aluminium top charge and a tetryl base charge, but if it is to be used in positions where it will be subjected to high temperature as well as high hydrostatic pressure, e.g. in deep wells or boreholes the explosive filling of the detonating fuse must have a melting point higher than this temperature and the detonator and the explosive charge external to it in the initiator should be of a kind which will not be adversely affected by high temperatures. One type of detonator which has been found eminently suitable for use where there is exposure to high temperature consists of a metal tube containing a pressed base charge of cyclo-trimethylene trinitramine on top of which is a pressed mixture of lead azide, lead styphnate and aluminium, above which is a pressed small charge of a corned mixture of lead dinitroresorcinate and potassium chlorate on which lies a loose charge of the same composition in which there sits an electric bridge wire the leading wires to which pass through a neoprene plug crimped to the metal tube.

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The leading wires of the detonator which pass through the closure means then pass out of the initiator through a hole in the screw cap. The dimensions of the perforations for the leading wires of the detonator in the closure means and the dimensions of the hole in the screw cap should be such that there is no possibility of damage to the insulation or the wires during the screwing on of the cap. The closure means may comprise at least one resilient washer and preferably comprises one resilient washer adapted to be compressed between a rigid plug, fitted with a key adapted to engage a keyway in the container of pressure resistant material, and a smaller rigid plug. This avoids the possibility of twisting of the detonator leading wires during the screwing on of the cap and consequent failure due to fracture of the wire or failure of the insula-

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tion thereof. The resilient washers may be made of any of the materials commonly used for such purposes, for example, rubber, neoprene and other similar materials. The rigid plug may be of any suitable pressure resisting material such as, for example "Tufnol" (Registered Trade Mark).

Suitable explosive compositions external to the detonator for use in the initiators of the invention which are stable under the temperature conditions existing in deep boreholes and have a high velocity of detonation include for example pentaerythritol tetranitrate or cyclotrimethylene trinitramine. Other explosives of similar properties may also be used. The explosives used must, if they are to be used where there is exposure to high temperatures, be stable to heat. The charge may be pressed into the bottom of the initiator if desired or may be loosely filled therein. A suitable explosive charge external to the detonator for use with a No. 6 detonator consists of 1—2 grams of pentaerythritol tetranitrate or 1—2 grams of cyclotrimethylene trinitramine. These may be used whenever a textile detonating fuse filled with pentaerythritol tetranitrate is applicable.

The whole container is resistant to the hydrostatic pressure to be encountered in its use and may be so constructed that a portion in close proximity to the ends of the lengths of detonating fuse is fractured by the firing of the detonator and the remainder is not destroyed, or it may be so constructed that it is totally destroyed by the firing of the detonator. It is preferred that it be such that only the part in close proximity to the lengths of detonating fuse is destroyed. The container and cap may be made of any material which can conveniently be shaped and will withstand the pressures involved. Suitable materials include metals such as steel, brass and the like. Brass and similar alloys are preferred on account of their cost and ease of working.

The means for positioning at least one length of detonating fuse may consist of a plate adapted to be screwed on to a threaded portion of the container and having one or more rows of holes of a size such as will allow the passage of the detonating fuse around its periphery or may be a suitably shaped projection made integral therewith. The former structure is preferred since this makes manufacture easy and gives an article capable of being packed more compactly. It is also preferred to use a metal such as brass for this purpose. In a preferred embodiment of the invention the means for positioning at least one length of detonating fuse consists of a circular plate having a central threaded hole and a row of holes surrounding this which are of a size suitable to allow the passage of detonating fuse and the container is one wherein a portion of its length is of a thickness such that on firing of the detonator

failure of this portion takes place and wherein another portion of its length is of greater thickness and is provided at its end adjacent to the thinner portion with a threaded portion on to which the said circular plate is screwed.

In using the initiator of the invention the detonating fuse may be attached in any one of a number of ways. Thus one length of fuse may be passed through each hole, a double length of fuse may be passed through two adjacent holes so that the weight of the fuse retains it in position or the total length of fuse may be threaded through the holes in one length. Alternatively if it is desired to use a larger amount of fuse single pieces of length up to twice the height over which an explosion is desired may be threaded through each hole so that there suspends from the outer periphery of each hole two lengths of fuse which may or may not be of equal length.

The initiators of the invention can be used in any position where there is exposure to high hydrostatic pressure. They are of greatest utility, however, where there is exposure to high temperature in addition to high hydrostatic pressure in which cases it is necessary that the detonators and base charges used should be stable to heat.

The invention is illustrated with reference to the diagrammatic drawings accompanying the Provisional specification in which Figure 1 shows a vertical section of an initiator according to the invention with the detonator and the base charge removed, Figure 2 shows the means for attachment of lengths of detonating fuse and Figure 3 shows the detonator with its leading wires threaded through the sealing means, the components of the seal having been separated to show them more clearly. In the diagrammatic drawings 1 is a pressure resisting metal tube externally threaded at 2 to engage the internal thread of a metal cap 3 provided with a hole 4 of such a size as to allow the passage of a pair of detonator leading wires. The tube 1 is also threaded at 5 so that a circular plate 6 provided with a single peripheral row of holes 7 can be screwed thereon. The wall thickness between the plate 6 and the closed end of the tube 1 is less than at other parts of the tube 1. The tube 1 is provided with a keyway 8 at its open end. 9 is an electric detonator closed by the plug 10 crimped thereon. The detonator leading wires 11 pass through a "Tufnol" (Registered Trade Mark) disc 12, a rubber disc 13 and a "Tufnol" plug 14, and finally (not shown in Fig. 3) through the hole 4 in cap 3. The "Tufnol" plug 14 is fitted with a metal key 15 which engages in keyway 8. The closure means made up of "Tufnol" disc 12, rubber disc 13, and "Tufnol" plug 14 is able to withstand a hydrostatic pressure of 5 tons/sq. in.

What we claim is:—

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1. An initiator capable of resisting hydrostatic pressure comprising a container, closure means therefor, and a screw cap for the container wherein said container has within it a charge of an explosive composition having a high velocity of detonation and an electric detonator the base of which is in close proximity to said charge and the leading wires of which pass through said closure means, wherein said closure means and screw cap form a pressure resisting fluid-tight seal for the container, wherein said container is provided with means external to it to permit the positioning of at least one length of detonating fuse in the vicinity of the container, and wherein at least a portion of said container is adapted on the firing of said detonator and the explosion of said charge to permit initiation of said detonating fuse.

2. An initiator as claimed in Claim 1 wherein the detonator consists of a metal tube containing a pressed base charge of cyclotrimethylene trinitramine on top of which is a pressed mixture of lead azide, lead styphnate and aluminium, above which is a pressed small charge of a corned mixture of lead dinitroresorcinate and potassium chlorate on which lies a loose charge of the same composition in which there sits an electric bridge wire the leading wires to which pass through a neoprene plug crimped to the metal tube.

3. An initiator as claimed in Claim 1 or 2 wherein the screw cap has a hole to permit the leading wires of the detonator to pass therethrough.

4. An initiator as claimed in any of the preceding claims wherein the closure means comprises one resilient washer adapted to be compressed between a rigid plug, fitted with a key adapted to engage a keyway in the container, and a smaller rigid plug.

5. An initiator as claimed in any of the preceding claims wherein the charge of the

explosive external to the detonator is a charge of pentaerythritol tetranitrate.

6. An initiator as claimed in any of the Claims 1—4 wherein the charge of the explosive external to the detonator is a charge of cyclotrimethylene trinitramine.

7. An initiator as claimed in any of the preceding claims wherein the portion of the container which is adapted on the firing of said detonator and the explosion of said charge to permit initiation of said length of detonating fuse is in close proximity to the lengths of the detonating fuse.

8. An initiator as claimed in any of the preceding claims wherein the means to permit the positioning of at least one length of detonating fuse in the vicinity of the container consists of a plate adapted to be screwed on to a threaded portion of the container and having at least one row of holes.

9. An initiator as claimed in any of the Claims 1—7 wherein the means to permit the positioning of at least one length of detonating fuse in the vicinity of the container consists of a circular plate having a central threaded hole and a row of holes surrounding this which are of a size suitable to allow the passage of detonating fuse and the container is one wherein a portion of its length is of a thickness such that on firing of the detonator failure of this portion takes place and wherein another portion of its length is of greater thickness and is provided at its end adjacent to the thinner portion with a threaded portion on to which the said circular plate is screwed.

10. An initiator substantially as described and with reference to the diagrammatic drawings accompanying the Provisional specification.

ALFRED O. BALL,
Agent for the Applicants.

PROVISIONAL SPECIFICATION

New and Improved Blasting Initiator

We, IMPERIAL CHEMICAL INDUSTRIES LIMITED, of Imperial Chemical House, Millbank, London, S.W.1, a British Company, do hereby declare this invention to be described in the following statement:—

This invention relates to a new and improved blasting initiator which is particularly suitable for use under high hydrostatic pressures.

In deep wells it frequently occurs that the casing becomes jammed or the drill becomes jammed during drilling. One method of freeing such jammed drills or casings is to fire a small explosive charge in the vicinity while simultaneously applying a torque from the

upper end. The explosive charge used frequently takes the form of a number of suitable lengths of a detonating fuse. The object of the present invention is to provide an initiator suitable for such charges and similar purposes.

According to the present invention this object is achieved by an initiator comprising an electric detonator, a casing capable of resisting hydrostatic pressure consisting of a container portion and a screw cap, sealing means adapted to give a pressure and fluid-tight seal when said cap is screwed to the container portion and through which pass the leading wires of the said electric detonator, a charge of an explosive composition having a

high velocity of detonation in close proximity to the base of said detonator, and means adapted to position a plurality of lengths of detonating fuse in the vicinity of said casing, at least a portion of said casing in the vicinity of said charge being so constructed that on firing said detonator the explosion of said lengths of fuse is initiated.

The electric detonator used in the initiator of our invention may be any commercial electric detonator, for example a No. 6 ASA detonator, but if it is to be used in positions where it will be subjected to high temperature as well as high hydrostatic pressure it should be of a kind which will not be adversely affected by high temperatures, e.g. which may occur in deep wells or boreholes. One type of detonator which has been found eminently suitable for use where there is exposure to high temperature consists of a metal tube containing a pressed base charge of cyclotrimethylene trinitramine on top of which is pressed a mixture of lead azide, lead styphnate and aluminium above which is pressed a small charge of a corned mixture of lead dinitroresorcinate and potassium chlorate on which lies a loose charge of the same composition in which there sits an electric bridge wire the leading wires to which pass through a neoprene plug which is crimped to the metal tube. The leading wires of the detonator are carried through the sealing means and then out of the initiator through a hole in the screw cap. The point of exit of the detonator leading wires from the sealing means and the dimensions of the hole in the screw cap should be such that there is no possibility of damage to the insulation or the wires during the screwing on of the cap. The sealing means may comprise one or more resilient washers and preferably comprises one resilient washer adapted to be compressed between a rigid plug fitted with a key adapted to engage a keyway in the container portion of the pressure resistant casing and a smaller rigid plug. This avoids the possibility of twisting of the detonator leading wires during the screwing on of the cap and consequent failure due to fracture of the wire or failure of the insulation thereof. The resilient washers may be made of any of the materials commonly used for such purposes, for example rubber, neoprene and other similar materials. The rigid plug may be of any suitable pressure resisting material such as, for example "Tufnol" (Registered Trade Mark).

Suitable explosive compositions for use in the initiators of our invention which are stable under the temperature conditions existing in deep boreholes and have a high velocity of detonation include such as, for example pentaerythritol tetranitrate or cyclotrimethylene trinitramine. Other explosives of similar properties may also be used. The explosive used must, if they are to be used where there is

exposure to high temperatures, be stable to heat. The charge may be pressed into the bottom of the initiator if desired or may be loosely filled therein. A suitable base charge for use with a No. 6 detonator consists of 1—2 g. of pentaerythritol tetranitrate or 1—2 g. of cyclotrimethylene trinitramine.

The container portion of the casing which is resistant to hydraulic pressure may be so constructed that the portion in close proximity to the ends of the lengths of detonating fuse is fractured by the firing of the detonator and the remainder is not destroyed or it may be so constructed that it is totally destroyed by the firing of the detonator. It is preferred that it be such that only the part in close proximity to the lengths of detonating fuse is destroyed. The container and cap may be made of any material which can conveniently be shaped and will withstand the pressures involved. Suitable materials include metals such as steel, brass and the like. Brass and similar alloys are preferred on account of their cost and ease of working.

The means adopted to position the lengths of detonating fuse may consist of a plate adapted to be screwed on to a threaded portion of the container portion of the casing and having one or more rows of holes of a size such as will allow the passage of the detonating fuse around its periphery or may be a suitably shaped projection made integral therewith. The former method is preferred since this makes manufacture easy and gives an article capable of being packed more compactly. It is also preferred to use a metal such as brass for this purpose. In a preferred embodiment a circular plate is used which is provided with a central threaded hole and a row of holes surrounding this which are of a size suitable to allow the passage of detonating fuse, in conjunction with a casing the container portion of which has a portion of its length of thickness such that on firing failure of this portion takes place and which has at least one other portion of its length of greater thickness, this portion of greater thickness being provided at its end adjacent to the thinner portion, with a threaded portion on to which the said circular plate can be screwed.

In using the initiator of our invention the detonating fuse may be attached in any one of a number of ways. Thus one length of fuse may be passed through each hole, a double length of fuse may be passed through two adjacent holes so that the weight of the fuse retains it in position or the total length of fuse may be threaded through the holes in one length. Alternatively if it is desired to use a larger amount of fuse single pieces of length up to twice the height over which an explosion is desired may be threaded through each hole so that there suspends from each hole two lengths of fuse which may or may not be of equal length.

5 The initiators of our invention can be used in any position where there is exposure to high hydraulic pressure. They are of greatest utility, however, where there is exposure to high temperature in addition to high hydraulic pressure in which cases it is necessary that the detonators and base charges used should be stable to heat.

10 Our invention is further illustrated by the accompanying drawings in which Figure 1 shows a verical section of an initiator according to our invention with the detonator removed, Figure 2 shows the means for attachment of lengths of detonating fuse and Figure 15 3 shows the detonator with its leading wires threaded through the sealing means, the components of the seal having been separated to show them more clearly. These components would, of course, require to be contiguous

prior to the assembly of the initiator. In the drawings 1 is a pressure resisting metal tube 20 externally threaded at 2 to engage the internal thread of a metal cap 3 provided with a hole 4 of such a size as to allow the passage of a pair of detonator leading wires. The tube 1 25 is also threaded at 5 so that a circular plate 6 provided with a single peripheral row of holes 7 can be screwed thereon and is provided with a keyway 8. 9 is an electric detonator closed by the plug 10 crimped thereon. The 30 detonator leading wires 11 pass through a "Tufnol" (Registered Trade Mark) disc 12, a rubber disc 13 and a "Tufnol" plug 14 which is fitted with a metal key 15 which engages in keyway 8. 35

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